Quantification of Uptake Coefficients of Isoprene-Derived RO_2 on Deliquesced NaCl Particles and the Amplification Effect of Transition Metal Ions

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Abstract

It has been explored whether heterogeneous uptake process contributes to peroxy radical loss process, thereby to suppression of ozone formation in the troposphere. While experimental data exist for heterogeneous loss of HO_2, information regarding RO_2 are limited. We develop a method that combines Laser Photolysis radical generation and time-resolved radical detection by Laser-Induced Fluorescence (LP-LIF) to measure the uptake coefficients of RO_2 onto aerosols (Kohno et al. 2021, Sakamoto et al. 2023). Isoprene, a biogenic volatile organic compound (BVOC), has the largest emission globally and significantly influences tropospheric chemistry. Isoprene undergoes oxidation to produce hydroxy-RO_2, or ISOPOOs, through the addition of OH. In this study, we aimed to investigate the impact of heterogeneous loss process on ISOPOO chemistry by using LP-LIF. We measured the uptake coefficient of ISOPOOs onto deliquesced NaCl particles under wet conditions at approximately 84% RH, room temperature 301 K and examined the influence of transition metal ions (Fe^{2+} and Cu^{2+}) on the uptake coefficient by doping with $FeCl_2$ and $CuCl_2$ at 5 wt% of NaCl. Our finding reveal that deliquesced pure NaCl particles exhibit an uptake coefficient of ~0.1 (Sakamoto et al. 2023). Furthermore, we observed that the addition of Fe^{2+} and Cu^{2+} increase these values by 5 and 2 times higher, respectively. These results suggest that, depending on the concentration of transition metal ions, the uptake coefficient of RO_2 radicals onto the aerosol may approach that of HO_2, requiring to investigate the RO_2 uptake as its loss process. In the presentation, we will also demonstrate validation and limitation of the system, and discuss possible mechanism controlling the uptake of ISOPOOs.

Early Career Scientist

NO, I am not an early career scientist.

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